

ADSC West Coast Chapter



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The International Association
of Foundation Drilling

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July 19, 2007

Mr. James Davis
Deputy Division Chief
Caltrans Geotechnical Services
1120 N. Street
Sacramento, CA

Subject: Constructability Issues with CIDH Piles

Jim:

As you had requested, I have attached a typical drilled shaft industry pre-bid check sheet that might be utilized when estimating a drilled shaft project to make sure the constructability concerns and issue are addressed. Below are some more specific comments a WCC drilled shaft contractor would have to address when looking at a CIDH piles poured utilizing tremie placement methods. Items that the West Coast Chapter hopes the structural design engineer of record is very aware of as well.

Shaft geometry

1. Shaft should be designed independent of the column. Column steel should not extend into any portion of the shaft, which must be placed by tremie methods. Or at least, allow for a Construction Joint (CJ) in CIDH Piles where column cage embeds (Laps).

Reasoning

Column placement tolerances are not compatible with Drilled Shaft tolerances.
Column steel density is often greater than can be dealt with in Drilled Shafts.
Removal of temporary casing over column steel is problematic
Maintaining location of reinforcement during casing removal is problematic
Correcting defects in shafts with column reinforcement already in place is problematic.
Column steel extending out of the shaft restricts the methods of casing removal available to the contractor.

2. Transition Zone (length of shaft where column reinforcement and shaft reinforcement overlaps) should be placed within a permanent casing (corrugated or smooth wall steel pipe) Transition zone concrete should be placed in the dry., with a CJ option, as mentioned above.

Reasoning

Permits the cleanout of the top of the tremie pour.
Permits the use of the casing as a cofferdam for safety for construction of column reinforcement and for placement of column form if shaft/column intersection is not at grade
Allows column cage to be set & poured after CIDH pile cage, better results in GGL testing.
Maintains design diameter of shaft in zones where overbreak may cause over pour.
Allows for vibration of concrete through multiple cages (column cage inside shaft cage) as well as placement inside and outside the cage to ensure no voiding. See comments on Reinforcement – article 3

3. Shafts should be designed so that they are somewhat larger than columns (usually two (2) feet.)

Reasoning

Permits the use of six inch cover on reinforcement
Permits the portion of column placed below grade to be constructed within the safety casing of the shafts See Shaft Geometry – article 2
Creates a stiffer shaft which forces the plastic hinge to the base of the column where it is more easily repaired in case of earthquake damage.

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4. Shafts should have their cutoff elevation as close to grade as possible. Often the shaft column interface is placed two (2) feet below existing ground.

Reasoning

Makes column forming simple

Makes access to plastic hinge simple

Makes depth to base of transition zone as shallow as possible

In no case should the construction joint be more than twenty (20) feet below grade – IMSHA problems

5. In situations where shafts are placed in water (river crossings) the transition from shaft to column should be as high as possible.

Reasoning

Keeps the difficulties of concrete cutoffs which are below the external water table to a minimum

Minimizes the need for cofferdams

Permits the use of permanent steel casings as the form for the shaft.

Shaft Concrete

1. Shaft concrete must have high workability limits (high slump) for a period of time exceeding the expected duration of the pour. This is accomplished by a combination of plasticizers and retarders. Concrete should have a slump of seven (7) inch minimum for a period of time equal to the length of the expected pour plus two (2) hours.

Reasoning; In a tremie pour, some, if not all, of the concrete from the first truckload placed travels to the top of the shaft. As such it must be workable for the entire period of the concrete placement.

2. ALL Shaft concrete should utilize a maximum of 3/8" aggregate

Reasoning; Research has shown that proper concrete flow can only be found when the clear reinforcement spacing is approximately 10 times the aggregate size. See Reinforcement – article 2

Reinforcement of Shafts

1. Shaft reinforcement should be straight. If bends (Hooks or tails) are necessary, they should be performed after shaft concrete has been placed and set.

Reasoning

Outbends (ACI Hooks/Tails) prevent the removal of temporary casing

In bends prevent the proper access of tremie equipment

In bends inhibit the access in case repairs must be made.

Reinforcement of Shafts (cont.)

2. Reinforcement should be constructed with minimum five (5") inch clear space for both verticals and horizontals. Vertical spacing can be accomplished by bundling bars. Horizontal spacing can be achieved by either bundling reinforcement hoops or rolling hoops from smooth bar sections.

Reasoning; See Concrete - article 2

3. Reinforcement used in tremie pours should never consist of multiple layers of steel (cage within a cage)

Reasoning; Proper flow of concrete cannot be assured.

4. CSL tubes should be bundled adjacent vertical bar bundles. GGL tubes placed 5" clear of vertical bar(s), same as 5" rebar window requirements

Reasoning; Minimizes the restriction on concrete flow. See Concrete - article 2

5. Cages should never be designed with reinforcement, which crosses through the interior of the shaft. Temporary shaft bracing which crosses the shaft should be removed before concrete placement.

Reasoning; Interferes with tremie placement & with subsequent repairs if necessary

6. No Figure "8" CIDH piles cage designs.

Reasoning; Proper flow of concrete cannot be assured.

We again, appreciate this opportunity to provide you with input regarding this matter. If you have any questions, please do not hesitate to contact us.

Respectfully Submitted,
West Coast Chapter of the ADSC

Michael J. Kennedy
WCC/Caltrans Committee Chairman

Pre-Bid Checklist

Project Name: _____

Bid Date: _____

Risk Assessment

(Pre-

Very Simple
(low risk)

☐ 1☐ 2☐ 3☐ 4☐ 5

Very Difficult
(high risk)

Estimate

Meeting w/Production Required on Risk 4-5 Jobs)

Documents

- a) Plans Dated: _____
- b) Specifications Dated: _____
- c) Addendums Noted: _____
- d) Soils Information – Report No. _____ Dated: _____
- e) Information Handout: _____
- f) Prequalification's: _____

Plans & Specifications

- a) Plans Conflict with Specifications, Specification Ambiguities: _____
- b) Incomplete Plan Information, Design Inefficiencies: _____
- c) Elevations / Tabulation Inaccuracies: _____
- d) Access – Corridors, Work Areas Adequate: _____
- e) Time – Construction Windows Adequate: _____
- f) Phasing: _____
- g) Tolerances – Vertical / Horizontal: _____
- h) Hazmat Requirements: _____

Pre-Bid Notifications

- a) RFC – request for clarifications in advance to the bid of duty engineers, owners or owner representatives.
- b) RFI – request for information – have these in prior to bid for necessary information to the appropriate parties.

Project

- a) Start Date: _____
- b) Submitted Due Dates: _____
- c) Submittal: _____

Drilled Shaft

- a) Constructability Issues: _____ Low Cut Off: _____ Water Table: _____
b) Core Samples Viewed: _____
c) Site Access / Conditions / Lay Down Area: _____
d) Utilities Above Ground: _____
e) Utilities Below Ground: _____
f) Hazardous Conditions / Contaminated Conditions: _____
g) Disposal of Water / Slurry / Filtration / Permits: _____
h) Polymer Disposal / Containment: _____
i) Spoils Removed / Stockpiled: _____
j) Shift Work: _____
k) Safety Issues: _____
l) SWPP Issues: _____
m) Casing – Permanent / Temporary / Removal: _____

Concrete

- a) Concrete Mix Design: _____ Wet Mix: _____ Dry Mix: _____
Concrete Quotation: _____ (reference project specs.)
b) Max Aggregate Flow Issues: _____
c) Slump: _____
d) Add Mixtures: _____
e) Pump / Place: _____ Tremie Diameter: _____
f) Night or Special Pour Requirements: _____
g) Average Pour Diameter: _____

Reinforcement

- a) Cage Max Length for Project: _____
b) Cage Max Weight: _____
c) Verification of Min-Vertical / Horizontal Bar Spacing of 5" x 5": _____
d) Cage Clearance From Edge of Bore Hole / Centralizers: _____
e) Required Splicing Mechanical, Lap.: _____
f) Single or Multiple Crane Pick: _____
g) Minimum Cage Set Allowed: _____
h) Guy-Off of Projected Steel: _____
i) Cage Delivered or From Stockpile: _____
j) Night or Day Pick: _____
k) Traffic Control For Pick: _____
l) Top of Cage: Hooks, 90's, Flare: _____

Integrity Testing

- a) PVC or Steel Pipes / Chairs – Concrete Flow Issues: _____
- b) Gamma Gamma or Cross Hole: _____
- c) Mass Concrete: _____
- d) Corrosion Resistant: _____

Test Piling

- a) Complete or Partial Pile: _____
- b) Osterberg Cell or Load Beam: _____
- c) Reaction Piles: _____
- d) Who Performs Test / Reporting: _____
- e) Removal of Test Pile: _____

Escalations

Concrete: _____ % Increase Per Year
Steel: _____ % Increase Per Year
Labor: _____ % Increase Per Year

SUBCONTRACT REVIEW CHECKLIST

PAGE 1

PROJECT NAME: _____ JOB NO: _____

- | | |
|---|--|
| <input type="checkbox"/> PRIME CONTRACT REFERENCED (OBTAIN COPY) | <input type="checkbox"/> BACKCHARGE CLAUSES |
| <input type="checkbox"/> GEOTECHNICAL REPORT (DATE, NO.) _____ | <input type="checkbox"/> SUBCONTRACTOR MUST AUTHORIZE IN WRITING |
| <input type="checkbox"/> SPECIFICATIONS AND DRAWINGS (DATE, NOS.) _____ | <input type="checkbox"/> CONSIDER TWO-WAY PROVISIONS |
| <input type="checkbox"/> STANDARD SPECIFICATIONS (DATE) _____ | <input type="checkbox"/> SCHEDULE PROVISIONS |
| <input type="checkbox"/> SPECIAL PROVISIONS (DATE) _____ | <input type="checkbox"/> MUTUALLY AGREED UPON |
| <input type="checkbox"/> ADDENDA (DATE) _____ | <input type="checkbox"/> SUBCONTRACTOR TO PROVIDE INPUT |
| <input type="checkbox"/> MASTER SUBCONTRACT AGREEMENT (DATE) _____ | <input type="checkbox"/> REVIEW PHASING / SEQUENCING OF WORK |
| <input type="checkbox"/> INSTRUCTIONS TO BIDDERS (DATE) _____ | <input type="checkbox"/> DIFFERING SITE CONDITIONS CLAUSES |
| <input type="checkbox"/> INSURANCE SPECIFICATIONS (DATE) _____ | <input type="checkbox"/> AVOID CLAUSES THAT NEGATE (DSC) |
| <input type="checkbox"/> SCHEDULE (REV. DATE) _____ | <input type="checkbox"/> SOILS REPORT MUST BE REFERENCED |

SCOPE OF WORK

- ☐ BID PROPOSAL ATTACHED (DATE) _____
- ☐ STANDARD CONDITIONS ATTACHED
- ☐ COMPARE SCOPE TO BID PROPOSAL
- ☐ AVOID ABIGUOUS LANGUAGE AND VAGUE CLAUSES

LISTED STANDARD EXCLUSIONS

- ☐ PERMITS, PERMISSION TO ENCROACH
- ☐ ACCESS (PROJECT REQUIREMENTS)
- ☐ SURVEY, CONTROL, LAYOUT, MONITORING
- ☐ PROTECTION, LOCATION, RELOCATION OF UTILITIES
- ☐ MATERIALS TESTING AND INSPECTION
- ☐ DRILL SPOIL STOCKPILE, LOADING, HAULING, DISPOSAL
- ☐ HAZARDOUS OR CONTAMINATED MATERIALS
- ☐ SITE DEWATERING
- ☐ OBSTRUCTIONS
- ☐ TRAFFIC CONTROL, FLAGGING, BARRICADES
- ☐ AS-BUILT DRAWINGS
- ☐ BOND
- ☐ RETENTION (5% / 45 DAYS AFTER SUB COMPLETION)
- ☐ RETENTION (REMOVALS TREATED SEPARATELY)

PAYMENT PROVISIONS

- ☐ AVOID PAY-WHEN-PAID CLAUSES
- ☐ ELIMINATE PAY-IF-PAID CLAUSES
- ☐ SEPARATE ITEM FOR MOBILIZATION
- ☐ MATERIALS-ON-HAND PROVISION
- ☐ VERIFY PROCEDURES FOR PAYMENT
- ☐ ELIMINATE JOINT CHECKS
- ☐ VERIFY RETENTION TERMS AND CONDITIONS

CONTRACTOR DAMAGE CLAUSES

- ☐ LIMIT LIQUIDATED DAMAGES
- ☐ ELIMINATE CONSEQUENTIAL DAMAGES
- ☐ BACKCHARGES (AGREED UPON DAILY)
- ☐ MINIMIZE MARK-UP
- ☐ LIMIT DELAY DAMAGES

SUBCONTRACTOR DAMAGE CLAUSES

- ☐ ELIMINATE NO-DAMAGES-FOR-DELAY
- ☐ UNIT PRICES FOR STANDBY AND DELAY
- ☐ UNIT PRICES FOR EXTRA WORK

SUBCONTRACTOR DEFAULT PROVISIONS

- ☐ LIMIT CONTRACTOR TAKE-OVER PROVISIONS
- ☐ MAXIMIZE TAKE-OVER TIMEFRAMES

DISPUTE CLAUSES

- ☐ ELIMINATE WAIVER OF RIGHTS PROVISIONS
- ☐ CONSIDER MEDIATION / ARBITRATION
- ☐ SUBCONTRACTOR SHALL BE ENTITLED TO EQUITABLE

COMPENSATION AND TIME EXTENSION FOR DELAYS

CAUSED BY CONTRACTOR OR THOSE UNDER ITS CONTROL

PROTECTION OF WORK CLAUSES

- ☐ OBTAIN COPY OF BUILDERS RISK POLICY
- ☐ NOT RESPONSIBLE FOR OVERALL SECURITY

CONDUIT CLAUSES

- ☐ OBTAIN COPY OF PRIME CONTRACT
- ☐ AVOID UNFAIR ONE-WAY PROVISIONS

VENUE CLAUSES

- ☐ MODIFY GEOGRAPHIC LOCATION
- ☐ CONSIDER A LOCAL JURISDICTION

PROJECT NAME: _____

JOB NO: _____

☐ INSURANCE PROVISIONS

- ☐ GENERAL LIABILITY
- ☐ EXCESS LIABILITY
- ☐ WORKMAN'S COMPENSATION
- ☐ AUTO LIABILITY
- ☐ DOES THE CONTRACT MATCH OUR INSURANCE
- ☐ EVALUATE LIMITS / DEDUCTIBLES

☐ SPECIAL INSURANCE

- ☐ AIRCRAFT
- ☐ BUILDERS RISK / ALL RISK
- ☐ EXPLOSION
- ☐ POLLUTION LIABILITY
- ☐ PROFESSIONAL LIABILITY
- ☐ RAILROAD PROTECTIVE
- ☐ RESIDENTIAL / CONDOMINIUM
- ☐ U.S. LONGSHOREMAN AND HARBOR WORKERS' (USL&H)

☐ INDEMNITY PROVISIONS

- ☐ LIMIT TO THE EXTENT OF ITS PROPORTIONATE FAULT
- ☐ ELIMINATE SOLE NEGLIGENCE
- ☐ AVOID PRIMARY WORDING

☐ LIST NAMED ADDITIONAL INSUREDS

- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____

☐ PAYMENT AND PERFORMANCE BOND

- ☐ RETENTION CLAUSE
- ☐ PERCENT OF RETENTION _____
- ☐ DUE WITHIN DAYS AFTER COMPLETION _____
- ☐ SEPARATE FOR PHASES AND REMOVALS
- ☐ ALLOWANCE FOR AN ESCROW ACCOUNT
- ☐ ALLOWANCE FOR RETENTION BOND

☐ RECEIVED INSURANCE POLICY

- ☐ RECEIVED INSURANCE CERTIFICATE
- ☐ RECEIVED LETTER OF INTENT FOR MATERIAL PURCHASE
- ☐ RECEIVED PURCHASE ORDER FOR SERVICES

☐ CROSS LIABILITY

☐ WAIVER OF SUBROGATION

☐ EVIDENCE OF PROPERTY

☐ NUMBER OF CANCELLATION DAYS

☐ OCIP / CCIP INSURANCE PROGRAM

☐ GENERAL LIABILITY AND EXCESS ONLY

☐ WORKERS' COMPENSATION ONLY

☐ ALL

☐ OTHER

☐ CREDIT REQUESTED

☐ DURATION OF COMPLETED OPERATIONS

☐ LIMITS / DEDUCTIBLES

☐ PROGRAM / INSURANCE POLICY